Making the V-Y advancement flap safer in fingertip amputations

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Amputation of the fingertip is a common injury of the upper extremity. Over the years, a variety of reconstructive techniques have been described. For dorsal oblique and transverse amputations, the Atasoy V-Y advancement flap is a popular choice because it preserves finger length, sensation and function. However, closure under tension remains a problem, putting the flap at risk of partial or full necrosis. To avoid this untoward complication, the classic V-Y advancement technique has been modified to allow for a tension-free closure.

Key Words: Atasoy flap; Fingertip injuries; V-Y flap

Fingertip amputations are among some of the most common injuries of the upper extremity (Figure 1). With the fingertip being the end organ for touch, preserving maximal function is of the utmost importance. Suboptimal reconstruction has the potential to significantly impact one's ability to work, thereby causing socioeconomic losses. Optimal reconstruction preserves finger length, sensation and functioning, and enables a quick return to work. Although a variety of reconstructive techniques have been described for dorsal oblique and transverse fingertip amputations, the Atasoy V-Y advancement flap is a popular choice.

The V-Y advancement flap was originally described by Tranquilli-Leali in 1935 (1), but was first reported in the United States by Atasoy et al (2) in 1970. With this technique, a triangular flap is designed with the base at the edge of the amputation and the apex at the distal interphalangeal crease. To mobilize the flap, the fibrous septa, anchoring the skin to deeper structures, are gently divided. To free the deep margin of the flap, the subcutaneous tissue is separated from the periosteum and flexor tendon sheath. The full thickness skin flap is then advanced over the exposed bone, and the neurovascular bundles are preserved. The base of the triangle is sutured to the nail bed, and the V-shaped donor site defect is closed as a Y (Figure 2).

The advantages of the V-Y advancement flap are the preservation of sensation and length, and good soft tissue coverage. Tension, however, is the primary problem encountered with this flap, especially with larger defects. The point of maximum tension occurs where the gap of the defect is greatest, which is in the mid portion of the defect. The need for a tension-free closure is highlighted in a variety of sources (3-6). If a tension-free closure is not achieved, the flap is at risk for necrosis. In addition, the distal nail bed may be pulled in the volar direction, creating a hook nail deformity. Over the years, the senior author (AT) has, on occasion, observed complete or partial flap necrosis when the

Rendre le lambeau de glissement en V-Y plus sécuritaire dans les cas d'amputation de l'extrémité du doigt

L'amputation de l'extrémité d'un doigt est une blessure qui affecte souvent le membre supérieur. Au cours des ans, diverses techniques de reconstruction ont été décrites. Dans les cas d'amputation à biseau oblique, dorsal et transversal, le lambeau de glissement en V-Y d'Atasoy est un choix populaire parce qu'il permet de préserver la longueur, la sensibilité et la fonctionnalité du doigt. Toutefois, la suture sous tension continue de poser problème et expose le lambeau à un risque d'une nécrose partielle ou complète. Pour éviter cette complication, la technique par lambeau de glissement en V-Y classique a été modifiée pour permettre une suture sans tension.

Figure 1) Transverse amputation of the tips of the right long and ring fingers

flap was executed by surgical residents in an emergency room setting. The main problem appeared to be tension at closure, following the classic closure method (as in Figure 2). The problem may be due to swelling that occurs after closure and after discharge from the emergency department. As a result, the senior author modified the execution of the flap to allow for a tension-free closure, thus avoiding this untoward complication (Figure 3).

MODIFICATION

First, it is important to emphasize that the movement of this flap is predicated on the division of septal attachments. Once the dermis is incised and subcutaneous fat is visible, one should not dissect deeper. This ensures protection of the neurovascular bundles. All of the soft tissue attachments on the undersurface of the flap are left intact. In essence, the flap is freed to allow it

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Figure 2) Classic V-Y advancement flap. Full thickness triangular skin flap is raised and advanced over the exposed bone. The V-shaped donor site defect is closed as a Y

Figure 3) The authors' modification. The only area of the flap that is loosely sutured is the base of the triangle to the nail bed. Instead of closing the V-shaped donor site defect in a Y pattern, the defect was left open and allowed to heal by secondary intention

to glide distally. This is not a true neurovascular flap. After the flap has been advanced, instead of closing the V-shaped donor site defect in a Y pattern, the defect is left open and allowed to heal by secondary intention. The only area of the flap that is loosely sutured is the base of the triangle to the nail bed, just to cover the bone. Even in this area, sutures are used sparingly. Small wound gaps are of no concern. Because the flap is only advanced a maximum of 1 cm, the consequent defect left at the base of the phalanx is small (Figure 4). Without the burden of tight closure and foreign suture material, this open area heals adequately by secondary intention.

The open wounds proximally and distally are then covered with a single layer of Xeroform (Covidien, USA) dressing, followed by a layer of wet and dry dressing. Xeroform is a sterile, nonadhering fine mesh gauze that has bacteriostatic properties (Figure 5). It also has occlusive properties, thereby providing a moist environment conducive to healing and protecting the wound from contamination (7). At the first follow-up visit, which occurs anytime between 72 h and five days postoperatively, the dressing is removed down to, but not including, the Xeroform gauze. The patient is then asked to bathe the finger in a warm Epsom salt or saline bath once daily for 1 min, and to then redress the digit with dry gauze. The Xeroform gauze is left covering the defect at all times. If these instructions are carefully followed, abscess formation should be avoided. In the authors' experience, by 10 to 12 days postoperatively, the wound is found to be completely healed on peeling off the

Figure 4) Intraoperative appearance of the advanced flap. No sutures are used proximally

Figure 5) Xeroform gauze (Covidien, USA). A single layer is used to cover the wound and aid in the healing process

Xeroform gauze (Figure 6). As with Atasoy's flap, length and sensation are maintained (Figure 7).

There are additional advantages to the modification such as potential reduction in the risk of hook nail deformities. This is explained by the fact that there is less tension at the tip of the finger because a counteractive proximal closure is not present at the apex on the V. Furthermore, the risk of hypersensitivity may be decreased. It is believed that there are two reasons for this. First, the digital nerves at the base of the flap are preserved. Second, the faster healing allows the patient to start using their fingers earlier. This can be regarded as a form of early desensitization therapy.

SUMMARY

By solely suturing the base of the triangle flap to the nail matrix and allowing the donor site defect to heal by secondary

Figure 6) Two weeks postoperation. The Xeroform gauze was just removed

intension, all of the benefits of the Atasoy flap are maintained. In addition, by leaving the donor site open, the primary problem associated with the Atasoy flap – closure under tension – is avoided.

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Figure 7) One month postoperation. The wounds are completely healed, and the sensation, range of motion and cosmetic results are excellent

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